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APPLICATION NUMBER: *60/356,277*
FILING DATE: *February 12, 2002*
RELATED PCT APPLICATION NUMBER: *PCT/US03/04085*

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

P. SWAIN
Certifying Officer

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02-14-02

Atty. Dkt. No. 026032-3770 A/PR

02/12/02 jc812 U.S. PTO

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Cussen et al.

Title: VEHICLE SEAT HAVING AN ELECTRONIC CONTROL SYSTEM

Appl. No.: Unknown

Filing Date: Unknown

Examiner: Unknown

Art Unit: Unknown

CERTIFICATE OF EXPRESS MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, Washington, D.C. 20231.

EL716378430US (Express Mail Label Number)

February 12, 2002 (Date of Deposit)

Roberta Cooper (Printed Name)

Roberta Cooper (Signature)

J1011 U.S. PTO 60/356277 02/12/02

60356277 021202

PROVISIONAL PATENT APPLICATION TRANSMITTAL

Commissioner for Patents
Box PROVISIONAL PATENT APPLICATION
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 37 C.F.R. § 1.53(c) is the provisional patent application of:

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001.1171703.1

Enclosed are:

[X] Specification (11 pages).

[X] Informal drawings (6 sheets, Figures 1-6).

[X] Application Data Sheet (37 CFR 1.76).

The filing fee is calculated below:

		Rate		Fee Totals
Basic Fee		$160.00		$160.00
[ ]	Small Entity Fees Apply (subtract ½ of above):		=	$0.00
	TOTAL FILING FEE:		=	$160.00

[X] A check in the amount of $160.00 to cover the filing fee is enclosed.

[ ] The required filing fees are not enclosed but will be submitted in response to the Notice to File Missing Parts of Application.

[X] The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Assistant Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447.

Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

Date 2/12/02

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Application Data Sheet

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Application Type::	Provisional
Subject Matter::	Utility
Suggested classification::	None
Suggested Group Art Unit::	None
CD-ROM or CD-R?::	None
Computer Readable Form (CRF)?::	No
Title::	VEHICLE SEAT HAVING AN ELECTRONIC CONTROL SYSTEM
Attorney Docket Number::	026032-3770
Request for Early Publication?::	No
Request for Non-Publication?::	No
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Total Drawing Sheets::	6
Small Entity?::	No
Petition included?::	No
Secrecy Order in Parent Appl.?::	No

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Assignee Information

Assignee name:: None

U.S. PROVISIONAL PATENT APPLICATION

for

VEHICLE SEAT HAVING AN ELECTRONIC CONTROL SYSTEM

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VEHICLE SEAT HAVING AN ELECTRONIC CONTROL SYSTEM

SUMMARY OF THE INVENTION

According to one exemplary embodiment, a vehicle seat having an electronic control system includes a track, a seat base coupled to the track, a seat back pivotally coupled to the track, seat base and back input devices, and a control circuit. The seat base has a seat base motor configured to move the seat base forward and backward. The seat back has a seat back motor configured to adjust an angle of inclination of the seat back. The seat base input device is configured to receive operator commands for movement of the seat base. The seat back input device is configured to receive operator commands for movement of the seat back. The control circuit is configured to receive the operator commands and to control the seat base motor and seat back motor. The control circuit is configured to move both the seat base and the seat back in response to receiving a command from the seat back input device and to move the seat base alone in response to receiving a command from the seat base input device.

According to one advantageous feature, the control circuit is configured to move the seat base at a first speed in response to receiving a command from the seat back input device and to move the seat base at a second speed faster than the first speed in response to receiving a command from the seat base input device.

According to another exemplary embodiment, an electronic control system for a vehicle seat comprises a seat base motor, a seat back motor, an operator input device, and a control circuit. The seat base motor is configured to move the seat base forward and backward. The seat back motor is configured to adjust an angle of inclination of the seat back. The operator input device is configured to receive operator commands for movement of the vehicle seat. The control circuit is configured to receive the operator commands and to control a seat base motor and seat back motor. The control circuit is configured to move both the seat base and seat back simultaneously at a ratio of approximately 1 degree of inclination of the seat back to approximately 1.5

millimeters of forward or backward movement of the seat base.

According to another exemplary embodiment, an electronic control system for a vehicle seat includes a seat base motor, a seat back motor, an operator input device, and a control circuit. The seat base motor is configured to move the seat base forward and backward. The seat back motor is configured to adjust an angle of inclination of the seat back. An operator input device is configured to receive operator commands for movement of the vehicle seat. The control circuit is configured to receive the operator commands and to control the seat base motor and seat back motor. The control circuit includes a voltage divider circuit configured to provide a first voltage across the seat base motor and a second voltage across the seat back motor, wherein the first and second voltages are different.

According to one advantageous feature, the control circuit is configured to move both the seat base and seat back simultaneously at a ratio of approximately 1.5 millimeters of forward or backward movement of the seat base to approximately 1 degree of inclination of the seat back.

According to another advantageous feature, the control circuit provides open loop control of the seat base motor and the seat back motor.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become more fully understood from the following detailed description, taken in conjunction with the accompanying drawings, wherein like reference numerals refer to like parts, and in which:

FIG. 1. is schematic drawing of a vehicle seat, according to an exemplary embodiment;

FIG. 2 is a schematic drawing of an electronic control system for a vehicle seat, according to an exemplary embodiment;

FIG. 3 is a schematic drawing of an electronic control system for a vehicle seat,

according to another exemplary embodiment;

FIG. 4 is a schematic drawing of an electronic control system for a vehicle seat, according to another exemplary embodiment;

FIG. 5 is a schematic drawing of an electronic control system for a vehicle seat, according to another exemplary embodiment; and

FIG. 6 is a schematic drawing of an electronic control system for a vehicle seat, according to another exemplary embodiment.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Referring first to FIG. 1, a vehicle seat 10 is shown in an exemplary embodiment. Vehicle seat 10 includes a seat base 12 and a seat back 14. Vehicle seat 10 can be a seat such as that disclosed in U.S. Provisional Application No. ____________ entitled "Automotive Seat With Live Back" to Hancock et al., filed concurrently herewith, which is incorporated by reference herein. Seat base 12 and seat back 14 are coupled to a track, such as an adjuster or other mounting member. Seat base 12 includes a seat base motor (not shown) configured to move the seat base forward and backward, as indicated by arrow 16. Seat back 14 includes a seat back motor (not shown) configured to adjust an angle of inclination, as indicated by arrow 18, of seat back 14. Vehicle seat 10 can further include motors configured to adjust the vertical height of seat base 12 (arrow 20) and the back of seat base 12 (arrow 22).

An electronic control system 24 for vehicle seat 10 includes a control circuit 26, a plurality of motors 28, and an operator input device 30. Motors 28 include seat back motor 32 configured to adjust the angle of inclination of seat back 14 and seat base motor 34 configured to move the seat base forward and backward. Motors 28 can be any of a number of different motor types, such as direct current motors, servo motors, electromagnetic control motors, etc.

Control circuit 26 includes circuit elements needed to drive motors 28 and to receive commands from operator input device 30. Control circuit 26 can include analog

and/or digital circuit elements, and can include a digital processor, such as, a microprocessor, microcontroller, application specific integrated circuit (ASIC), etc. Controller circuit 26 is configured to drive motors 28 using pulse-width modulated signals, direct current signals, or other control signals.

Operator input device 30 is shown in schematic form having a seat back button 36 and a seat base button 38. Each of buttons 36 and 38 instructs the user that the button is for the control of seat back 14 and seat base 12, respectively, by an applicable icon or, in this exemplary case, by shaping the button to correspond generally to a seat base or a seat back. In this manner, the user understands which button is for control of which portion of vehicle seat 10. Seat back button 36 is configured to be moved forward and backward as indicated by arrow 40 to adjust the angle of inclination of seat back 14 via control circuit 26 and seat back motor 32. Seat base button 38 is configured to adjust the forward and backward (fore-aft) position of seat 12 as indicated by arrow 42 and is further configured to move the front and back of seat base 12 upward and downward, selectively, as indicated by arrows 44 and 46. Operator input device 30 is an "8-way" switch in this exemplary embodiment, but may alternatively be a 6-way switch, or other switches.

Electronic control system 24 is configured in this exemplary embodiment to receive operator commands via input device 30 and to control motors 28. According to one advantageous embodiment, control circuit 26 includes a "power glide" feature wherein seat base 12 and seat back 14 are both moved in response to receiving a command from seat back button 36. Preferably, control circuit 26 is configured to move seat base 12 at a slower speed when receiving a command from seat back button 36 than when moving seat base 12 in response to a command from seat base button 38. It has been found that an optional relationship of movement between seat back 14 and seat base 12 to provide a "glide" effect includes moving seat base 12 and seat back 14 simultaneously at a ratio of approximately 1.5 millimeters (mm) of forward or backward movement of seat base 12 to approximately one degree of inclination of seat back 14. The ratio may alternatively be any value between 1.0 mm/one degree and 3.0 mm/one degree. Advantageously, the "power glide" feature

of moving both seat base 12 and seat back 14 simultaneously in response to actuation of seat back button 36 provides improved user comfort and avoids multiple repositioning commands which would otherwise be needed to place vehicle seat in an optimal seating position.

In this embodiment, movement of seat base 12 during the "power glide" movement is at a speed slower than that of movement outside of the "power glide" feature. Thus, if the user actuates seat base button 38 along the direction of arrow 42, seat base 12 will move at a speed faster than that during movement according to the power glide feature. Likewise, movement of seat base 12 in the direction of arrows 20 and 22 will also provide the faster movement. In this exemplary embodiment, seat back 14 can not be moved without movement of seat base 12, unless seat back 14 has reached a mechanical or preset limit to its angle of inclination.

Referring now to FIG. 2, an exemplary embodiment of control circuit 26 will now be described as control circuit 50. Control circuit 50 includes four switches, switch 1, switch 2, switch 3, and switch 4. Control circuit 50 further includes relay 1, relay 2, and a resistor R. Resistor R has a resistance of between 1 and 2 Ohms and is rated for approximately 50 watts, but may alternatively have other resistance and power characteristics. Seat back motor 32 (or recliner motor) is disposed parallel with resistor R and seat base motor 34 (or cushion motor). Relay 1 is configured to switch one terminal of seat base 34 between resistor R and switch 3. Relay 2 is configured to switch a second terminal of seat base motor 34 between switch 2 and switch 4. Each of switches 1, 2, 3, and 4 is configured to select either battery or ground from a vehicle power source to motors 32, 34 and relays 1, 2. Switches 1 and 2 are connected to seat back button 36 and cannot be activated at the same time. Switches 3 and 4 are connected to seat base button 38 and cannot be activated at the same time. When recliner button 36 is moved forward (FIG. 1, arrow 40), switch 1 connects the battery to the terminal between motor 32 and resistor R to drive seat back 14 forward. The power from the battery is provided through resistor R to seat base motor 34 to drive seat base motor 34 at a speed of approximately 1.5 millimeters per degree of inclination of seat back 14. Thus, resistor R is part of a voltage divider network

configured to provide a first voltage across motor 32 and a second, smaller voltage across motor 34. In response, motor 32 moves at a regular speed and motor 34 moves at a reduced speed from its regular speed.

When seat back button 36 is moved backward (FIG. 1, arrow 40), switch 2 provides power from the battery to the other terminal of seat back motor 32 to drive seat back 14 backward. Switch 2 also provides the battery power to seat base motor 34 through relay 2 and relay 1 and resistor R to move seat base 12 forward at a speed of 1.5 millimeters per degree of inclination of seat back 14.

When seat base button 38 is moved backward (FIG. 1, arrow 42), switch 3 provides battery power to a coil of relay 1 which switches the input to seat base motor 34 from resistor R to switch 3 and switches the other terminal of seat base motor 34 from switch 2 to switch 4 via a coil of relay 2. Since vehicle power is provided directly through motor 34 (i.e., not via resistor R), motor 34 is driven at a faster, regular speed than when power was provided through resistor R. Seat base motor 34 drives seat base 12 backward and seat back motor 32 is not driven, whereby seat back 14 does not move.

When seat base button 38 is moved forward (FIG. 1, arrow 42), switch 4 provides power from the battery through the coils of relay 2 and relay 1 to connect the terminals of seat base motor 34 to switches 3 and 4. Power returns through switch 3 to ground, thereby driving seat base 34 in the forward direction at the faster, regular speed. When switches 1 and 3 are activated simultaneously, indicating a command to move seat back forward and seat base 12 backward, relays 1 and 2 are activated, and both motors 32 and 34 are actuated at full speed to carry out the user command. If switches 1 and 4 are activated simultaneously, again relays 1 and 2 are activated such that both commands are carried out at full speed. Likewise, if switches 2 and 3 or switches 2 and 4 are activated (corresponding to user commands of seat back 14 backward and seat base 12 backward, and seat back 14 backward and seat base 12 forward, respectively), movement of motors 32 and 34 is carried out at regular speed, because resistor R is not included in the circuit for providing power from battery to

ground through motors 32 and 34.

Referring now to FIG. 3, a schematic diagram of a control circuit 52 according to an alternative embodiment is shown. Control circuit 52 is the same as control circuit 50, except that switch 3 is coupled to the coil of relay 1 through a diode 54 and switch 4 is coupled to a coil of relay 2 through a diode 56. The anodes of diodes 54 and 56 are coupled to switches 3 and 4, respectively, and the cathodes of diodes 54 and 56 are coupled together and to the coils of relays 1 and 2. The opposite ends of the coils of relays 1 and 2 are coupled to ground. Diodes 54 and 56 protect the relay coils from turn-on and turn-off voltage transients from motor 34 (also referred to as inductive kick).

Referring now to FIG. 4, a further exemplary embodiment of control circuit 26 is shown as control circuit 58. In this embodiment, relays 1 and 2 of the embodiments of FIGS. 2 and 3 are replaced with two additional switches, switch 3' and switch 4'. Each of switches 1, 2, 3, 3', 4, and 4' are illustrated in this drawing and in the other drawings of the present application in their rest or sleep state, also called the non-activated state. Seat back button 36 is illustrated and includes arrow 40 indicating that forward movement of button 36 corresponds to actuation of switch 1 and backward movement of button 36 corresponds to actuation of switch 2. Likewise, seat base button 38 is illustrated along with arrow 42, indicating that backward movement of button 38 corresponds to actuation of switches 3 and 3' and forward movement of button 38 corresponds to actuation of switches 4 and 4'.

In this embodiment, resistor R is coupled between switch 1 and switch 3. Switch 3 selectively couples the other terminal of switch 3 between ground and switch 4'. Switch 4' selectively couples switch 3 to either battery or motor 34. The other terminal of motor 34 is coupled to switch 3'. Switch 3' couples the other terminal of motor 34 selectively to the vehicle battery or to switch 4. Switch 4 couples switch 3' selectively to either ground or switch 2. As in the embodiments of FIGS. 2 and 3, recliner motor 32 is coupled between switch 1 and switch 2, and switches 1 and 2 selectively couple either battery or ground to motor 32 to drive motor 32 in the

forward or backward direction.

In operation, switches 1 and 2 are connected to button 36 and cannot be activated at the same time. Switches 3 and 3' are connected together and are activated by backward movement of button 38. Switches 4 and 4' are connected together and are activated by forward movement of button 38. When button 36 is moved forward, switch 1 is activated to provide battery power through motor 32 and to resistor R, switch 3, switch 4', through motor 34, to switch 3', to switch 4, to switch 2 and to ground. In this manner, motor 34 is driven at a reduced speed, preferably 1.5 millimeters per degree movement of motor 32.

When button 36 is moved backward, switch 2 is actuated to couple battery power through motor 32 to switch 1 to ground and to provide battery power through switch 2 to switch 4 to switch 3' through motor 34 to switch 4' to switch 3 through resistor R to switch 1 to ground. In this manner, seat back 36 moves backward and seat base 12 moves forward at a reduced speed.

When button 38 is moved forward, switches 4 and 4' are activated wherein power is provided from switch 4' through motor 34 to switch 3' to switch 4 to ground, thereby moving motor 34 forward at regular speed. If button 38 is moved back, switches 3 and 3' are activated, wherein power is provided from the vehicle battery to switch 3' through motor 34 to switch 4' to switch 3 to ground, thereby moving motor 34 backward at regular speed. If buttons 36 and 38 are both moved forward, motor 32 moves forward at full speed and motor 34 moves forward at full speed. If buttons 36 and 38 are moved backward or some combination of forward and backward, motors 32 and 34 are moved together simultaneously at regular speed.

Referring now to FIG. 5, another exemplary embodiment of control circuit 26 is shown as control circuit 60. In this embodiment, switches 3 and 3' and switches 4 and 4' of the embodiment of FIG. 4 are replaced with 3-way switches, wherein switch 3 couples one terminal of motor 34 to battery power, to ground, or to resistor R. Likewise, switch 4 is configured to couple the other terminal of motor 34 to battery

power, to ground, or to the terminal between switch 2 and motor 32. Motors 32 and 34 are disposed in parallel with one terminal shared by resistor R and motor 32. When button 38 is actuated alone, switch 3 provides battery power to motor 34 and switch 4 provides a closed circuit to ground. When button 38 is actuated forward alone, battery power is provided through switch 4 to motor 34 and switch 3 provides a closed circuit to ground. When seat back button 36 is actuated forward or backward, switches 3 and 4 are in their rest state, wherein power is provided to motor 34 only through resistor R, thereby moving motor 34 at a slower speed than when button 38 is actuated alone. Further, when button 38 is actuated simultaneously with button 36, power is provided separately to motors 32 and 34, and not through resistor R, such that both motors are moved at their full, regular speeds in both directions.

Notably, in the embodiments of FIGS. 2-5, resistor R comprises a portion of a voltage divider circuit configured to provide a first voltage across seat base motor 34 and a second voltage across seat back motor 32, wherein the two voltages are different. The difference in voltages can be used to drive motor 34 at a different speed than motor 32, preferably at a slower speed, to provide a power glide feature. Also of note, the circuits of FIGS. 2-5 provide open loop control, wherein no feedback is provided as to the position of motors 32 and 34. According to one alternative embodiment, feedback may be provided to further improve positioning of motors 32 and 34.

Referring now to FIG. 6, an alternative embodiment of control circuit 26 is shown as control circuit 62. In this embodiment, a digital processor, preferably a microprocessor 64 provides control signals to seat base motor 34 and/or seat back motor 32 (not shown). In this embodiment, a pulse-width modulated control signal is provided at microprocessor output 66 to a transistor 68, which is a temperature-protected field effect transistor (FET) in this exemplary embodiment, but may alternatively be other transistors. Transistor 68 is a BTS282Z transistor manufactured by Infineon Technologies, Munich Germany. The temperature protection provides the advantage of protecting the FET from excess heat due to prolonged use or continuous high current use. The source of transistor 68 is coupled to ground and the drain of transmitter 68 is coupled to one input of each of a plurality of relays 70, 72.

Relays 70 and 72 are actuated by digital outputs from microprocessor 64 indicated at output 74 and output 76. When seat base button 38 (FIG. 1) is moved forward or backward, digital signals are provided on output 74 and output 76, respectively, to drive relays 70 and 72 to provide power from a vehicle battery source to the motor 34. When seat back button 36 is actuated forward and backward alone, outputs 74 and 76 are not actuated, and an adjustable control signal is provided from microprocessor 64 via output 66 and transistor 68 to provide an amount of power to motor 34 less than that provided when relays 70 and 72 are actuated. Preferably, control circuit 64 is configured to control motor 34 at a slower speed when seat back button 36 is actuated than when seat base button 38 is actuated. Further, the speed ratio is preferably 1.5 millimeters of movement of seat base 12 for every one degree of movement of seat back 14. A diode 78 is provided between a vehicle battery source and transistor 68 for protection of transistor 68 from voltage spikes in the battery.

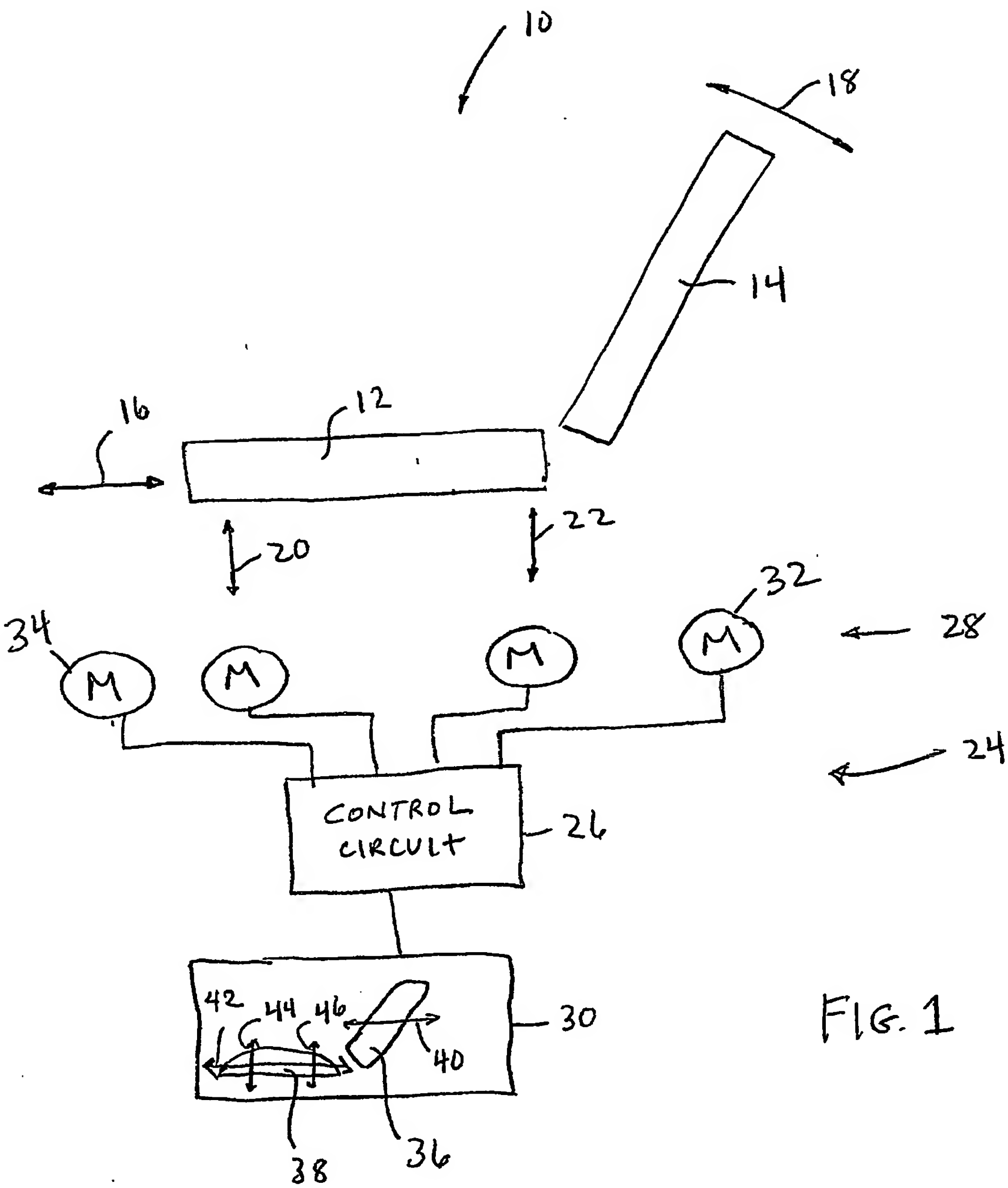
10
18
14
12
16
20
22
32
28
34
M
M
M
M
24
CONTROL CIRCUIT
26
30
42
44
46
40
38
36

FIG. 1

Attivo Power Glide System - Electronics

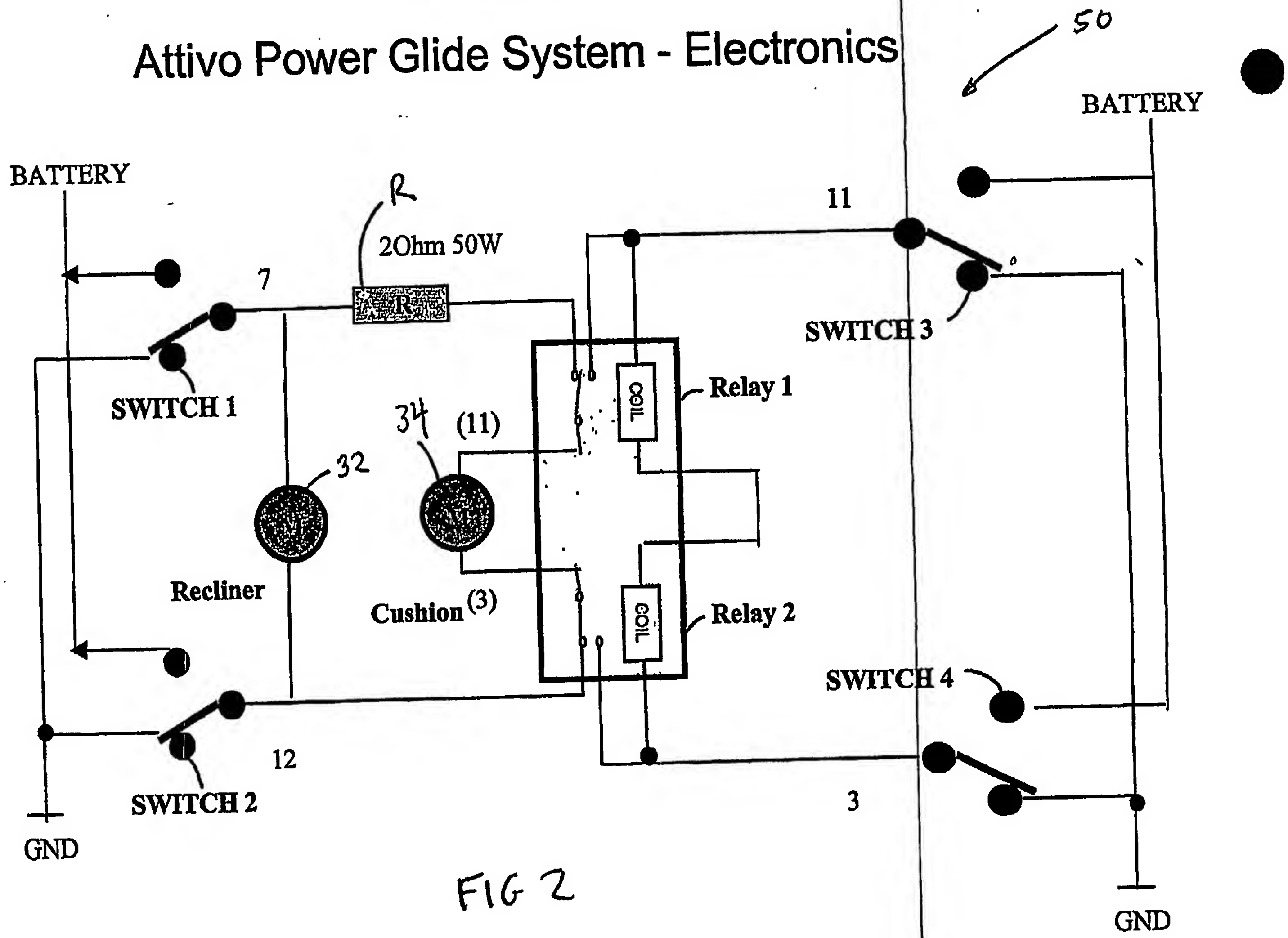

FIG 2

Attivo Power Glide System - Electronics

52

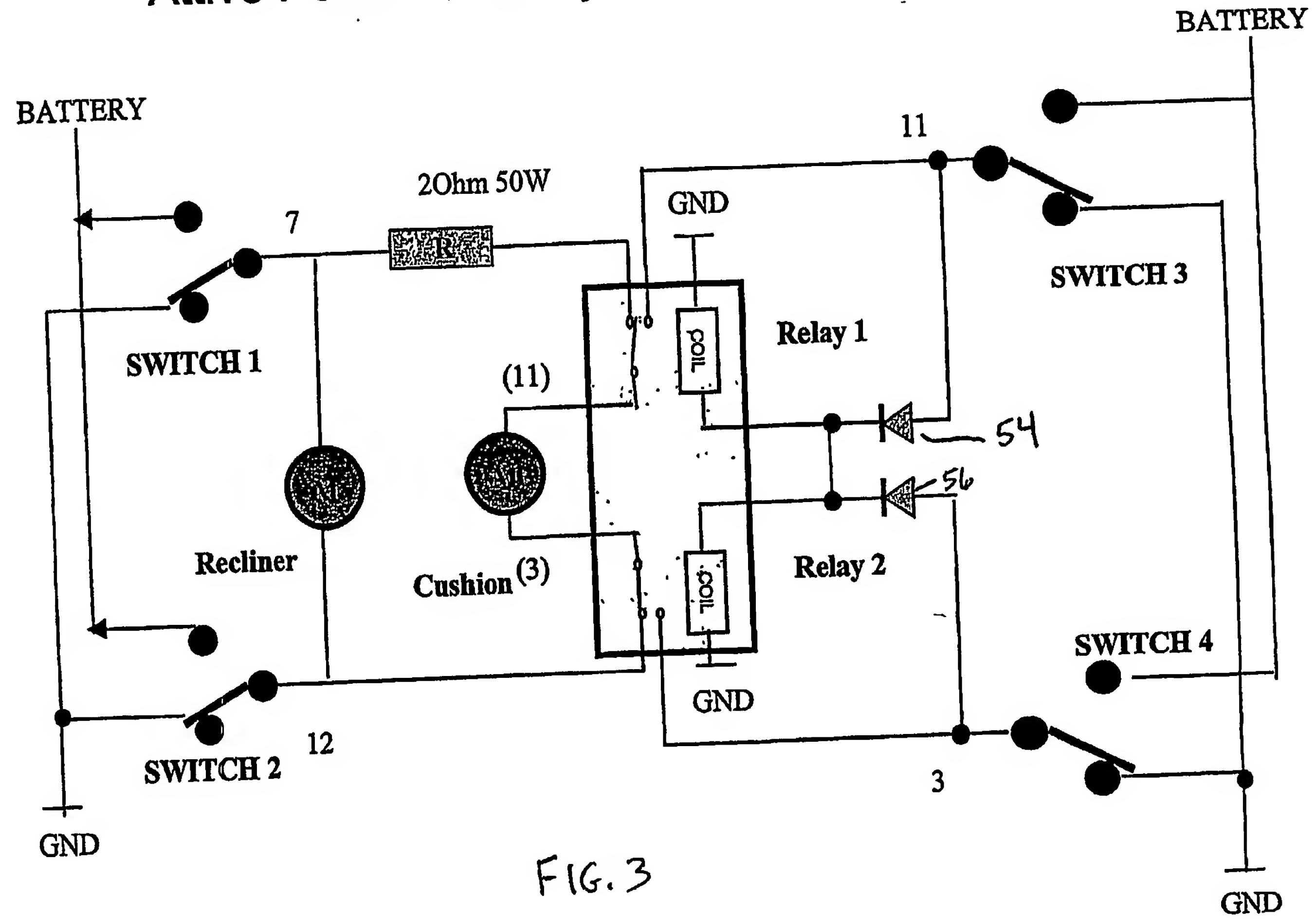

FIG. 3

Attivo Power Glide System - Switch Solution 1

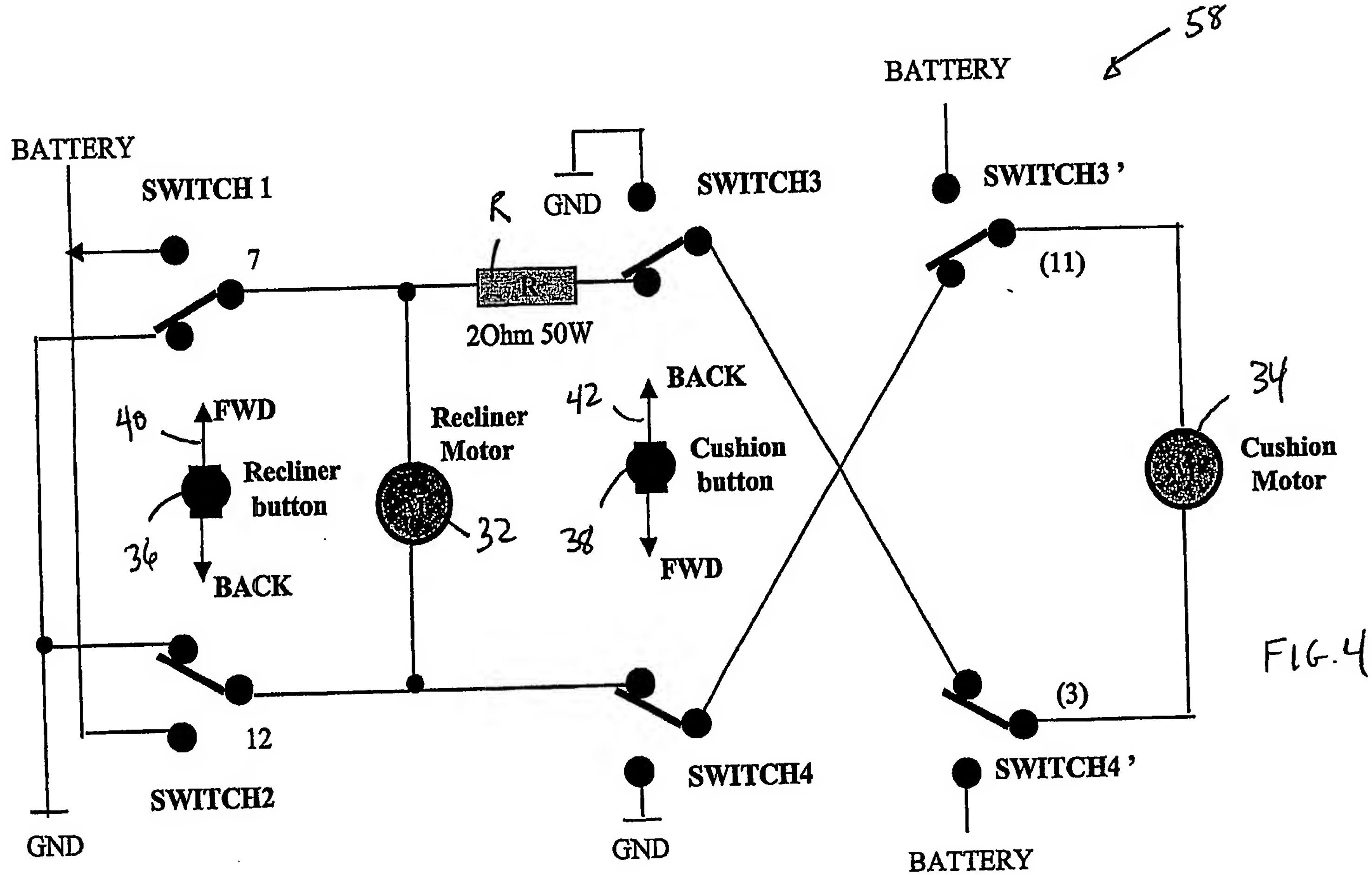

FIG. 4

Attivo Power Glide System - Switch Solution 2

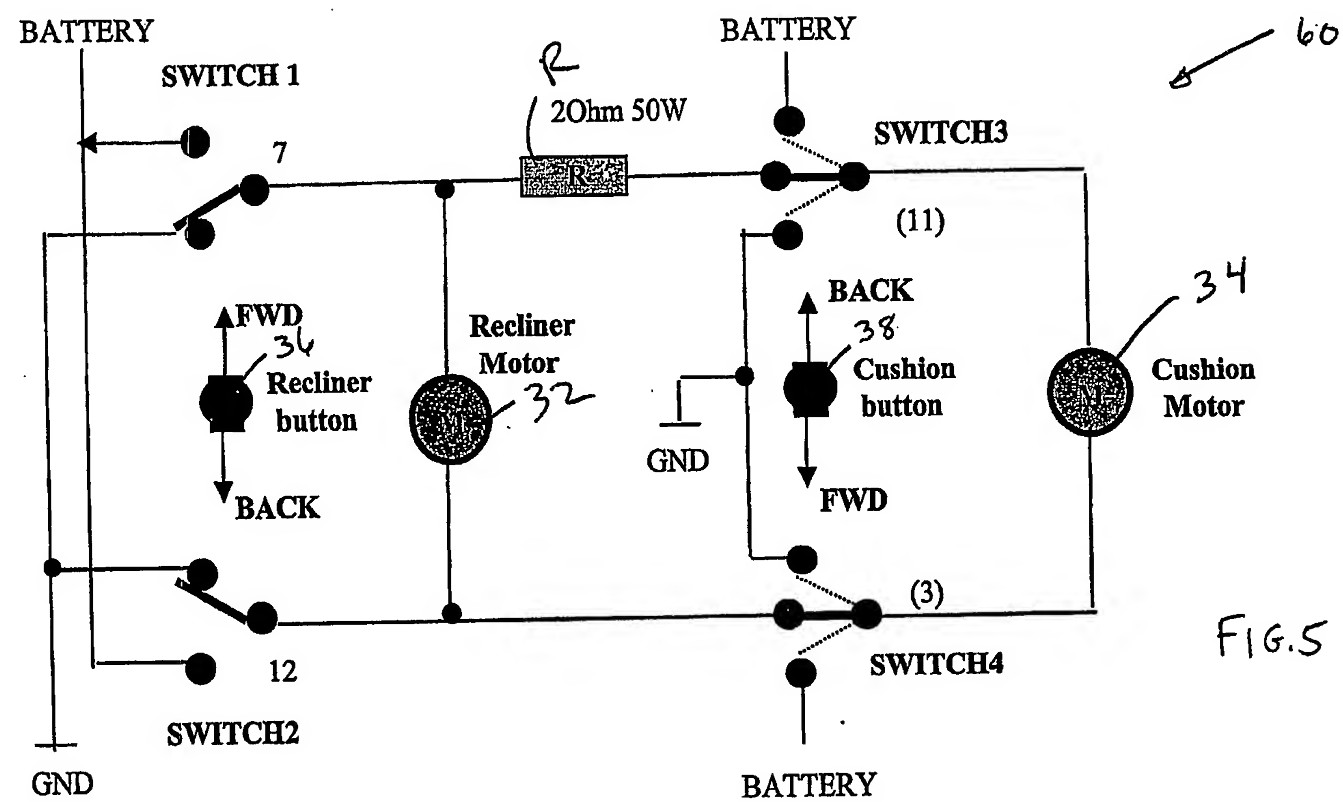

FIG.5

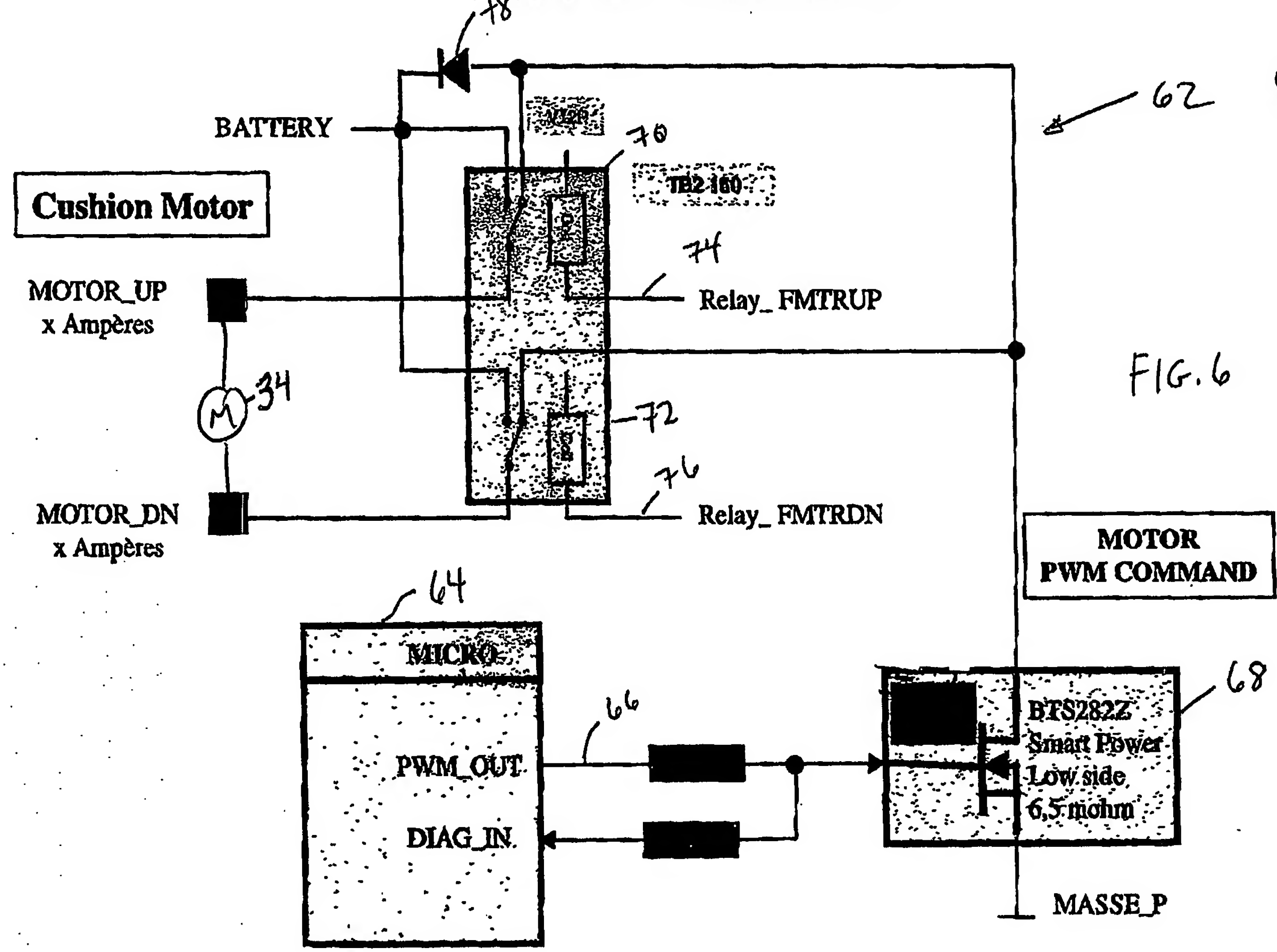
78
BATTERY
70
TB2 160
62
Cushion Motor
74
MOTOR_UP
x Ampères
Relay_ FMTRUP
34
72
76
MOTOR_DN
x Ampères
Relay_ FMTRDN
MOTOR
PWM COMMAND
64
MICRO
68
66
BTS282Z
Smart Power
Low side
6,5 mohm
PWM_OUT
DIAG_IN
MASSE_P

FIG. 6

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